BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

B69 09016

SUBJECT: Power Profile Generator for the AAP CSM - Case 620

DATE: September 9, 1969

FROM: L. L. Wang

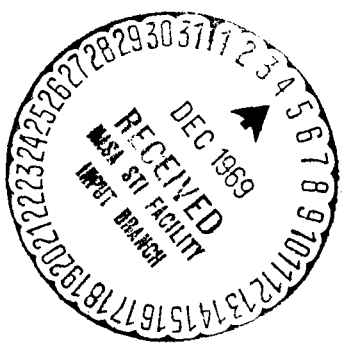
ABSTRACT

A computer program has been developed to determine the time-dependent power requirement of the AAP Command and Service Modules (CSM). The total power requirement is determined whenever there is a load change in the system. The mission average power requirement of the CM and SM are also computed by this program.

(NASA-CR-106867) POWER PROFILE GENERATOR FOR THE AAP CSM (Bellcomm, Inc.) 5 p

N79-72794

Unclas
00/33 11663



BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

B69 09016

SUBJECT: Power Profile Generator for the AAP CSM - Case 620

DATE: September 9, 1969

FROM: L. L. Wang

MEMORANDUM FOR FILE

INTRODUCTION

There are many CSM systems that require AC and DC power during the AAP missions. The power requirement of each system may be constant, cyclic, or totally dependent on mission events. A program, TFRAME, has been developed to determine the CM and SM power requirements for up to 50 different loads. The total power requirement in the CM or SM is computed every time a load change occurs in the system. The average total power of CM and SM during the entire mission are also calculated.

POWER SIMULATION

A 30 by 5 matrix A_i (i=1, 2,...) is used to store the information about the time and power requirement of the i^{th} system .

$$A_i = \begin{bmatrix} a_{1i} & b_{1i} & c_{1i} & d_{1i} & e_{1i} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ a_{ji} & b_{ji} & c_{ji} & d_{ji} & e_{ji} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ a_{30i} & b_{30i} & c_{30i} & d_{30i} & e_{30i} \end{bmatrix}$$

The first column is the time, the second column is the AC power requirement, the third column is the DC power requirement, the fourth column is the period of the power cycle, and the fifth column is the percentage of the cycle when the equipment is continuously on (dutv cycle). A zero

element in the fourth column is used to indicate that the system is not switched in cycles.

A subroutine, CONVER, is used to convert the j^{th} row of the matrix A_i into arrays of times, T_{ni}, and power requirements, P_{ji}. T_{ni} are the times that the power requirement changes. P_{ji} is the DC power required by the i^{th} system within the time between a_{ji} and $a_{j+1,i}$ and is computed as follows

$$P_{ji} = (b_{ji}/EFF + c_{ji}) \times I$$

Here EFF is the efficiency of the AC inverter and I=1 when $d_{ji}=0$ or when $a_{ji}+(m-1)\ d_{ji} \leq T_{ni} < a_{ji}+(m)d_{ji}e_{ji}$ (m is an integer (m=1, 2...)). Otherwise, I=0.

After each matrix A_i is converted, a subroutine TMIN is used to rearrange the time of load changes in an ordered sequence. The total CM power requirement P_{TC} and the total SM power requirement P_{TS} are calculated simutaneously at each time. Here

$$P_{TC} = \sum_{i=1}^{NCM} P_{ji}$$

$$P_{TS} = \sum_{i=NCM+1}^{NUMB} P_{ji}$$

NUMB is the total number of loads in the system and NCM is the total number of loads in the CM.

PROGRAM PERFORMANCE

A total of 24 loads, 19 in the CM and 5 in the SM, have been used in a problem to determine a sample CSM power profile for a 1338 hour mission. The total computer time for compilation and execution was about 6 minutes. There were about 4570 load changes during the mission, and the CM and SM power requirement were computed at each time. At present a maximum of 50 loads can be read in for profile determination. Printouts of the Fortran program TFRAME and subroutines CONVER and TMIN are available.

In any analysis, the accuracy of final numerical results are dependent on the accuracy of numerical input. As the system configuration of the dependent CSM for the Saturn Workshop program is defined, it is expected that this program, combined with accurate system timeline information, will yield valuable data on the power requirement imposed by the CSM on the Workshop.

Lily L Wang

1022-LLW-mef L. L. Wang

BELLCOMM, INC.

Subject: Power Profile Generator for the AAP CSM - Case 620

From: L. L. Wang

Distribution List

NASA Headquarters

H. Cohen/MLR
P. E. Culbertson/MLA
J. H. Disher/MLD
W. B. Evans/MLO
L. K. Fero/MLV
J. P. Field, Jr./MLP
T. A. Keegan/MA-2
M. Savage/MLT
W. C. Schneider/ML

Bellcomm

A. P. Boysen
D. R. Hagner
W. G. Heffron
B. T. Howard
J. Z. Menard
J. M. Nervik
I. M. Ross
J. W. Timko
R. L. Wagner
M. P. Wilson
Departments 2031, 2034 Supervision
All Members Division 102
Department 1024 File
Central File
Library